"NASA Activities in Risk Assessment"

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Over the past few years, NASA has aggressively pursued a program aimed at applying modern probabilistic risk assessment (PRA) techniques to important Agency programs. NASA's multi-pronged approach has focused on: developing requirements and guidelines for conducting PRA in the various types of NASA program; training practitioners on state-of-the-art methods used in PRA; developing training tools for PRA (a PRA Procedures Guide for practitioners and manager and a Fault Tree Handbook for practitioners); adopting and developing state-of-the-art integrated computer programs to perform a PRA; developing an Agency-wide PRA database; conducting PRA on major programs (Space Shuttle, International Space Station, Mars missions, etc.) and peer reviewing them with the assistance of internationally recognized PRA experts. Although much of the PRA methodology used in other industries is applicable to the NASA applications, some of the applications are unique and have required special consideration and unique methods. These include: incorporating multi-phase missions into risk assessment; considering special phenomena that are important contributors to risk in NASA missions, e.g., micro-meteoroid and orbital debris (MMOD); illness in space; zero-gravity effects on human performance and reliability and on phenomena that can be important risk contributors like fires. NASA has also developed and applied dynamic PRA techniques and associated software at the system (fault-tree) level as well as at the scenario (event tree) level. Although important in PRA applications in all technological fields, human reliability is of paramount importance in aerospace applications because of the high dependence on highly trained humans (astronauts) in space missions and because of the important role of humans in ground processing. Also, software reliability is of paramount importance in NASA mission that are both human flights and un-manned flights into deep space that depend almost exclusively on control and operation via software. Until recently, NASA has applied PRA to a variety of phases of the product fuel cycle including: improved operation and upgrade (Space Shuttle); assembly and successful operation and maintenance in space (International Space Station); meeting safety requirements (nuclear payload missions and Mars Sample Return mission). Now, NASA has decided to use PRA in setting safety design criteria and improving design for the Orbital Space Plane (OSP), the next generation of space transportation. NASA is increasingly expanding its use of PRA safety improvement and mission success enhancement thus attempting to make the best use of PRA for the purpose it has always been intended, namely improving management decisions.